Space Weather Technical Forecast

Issued on Friday 28 February 2025 at 01:22 Local

This technical forecast provides a four-day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: Isolated M-class flares likely. Isolated G1/Minor Storms likely, mainly today (28 Feb).

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Low with occasional C-class flares, the peak flare was C9.3 at 27/2324 UTC from AR3998 in the southwest. There are currently nine sunspot regions on the Earth-facing disc, most of which are very small and weak, magnetically simple and either stable or decaying. The most likely flare source is AR3998, which is the largest region on the disc, however this region is expected to rotate onto the southwest limb today (28 Feb). AR4006 in the northeast is only slight smaller than AR3998, and has a similar moderate magnetic complexity with an Eki/beta-gamma classification. However, AR4006 has been stable recently and not a source of the C-class flares, unlike AR3998.

A filament eruption which occurred around 27/1730 UTC near the NE limb generated a CME. This is yet to be fully analysed but is not expected to be Earth directed.

Solar Wind / Geomagnetic Activity: The solar wind, as measured by ACE/DSCOVR at L1, has connected with a High Speed Stream (HSS) from CH19/+ with speeds generally between 540-620 km/s. A very weak CME may have also arrived around the middle of the day, with the CME impacts boosted by the solar wind enhancement from the current HSS. If a CME arrival did occur there is a possibility that it was the CME from the 24th. Density is likely to have been above average throughout, reaching 22 ppcc in the afternoon, despite apparent initial below average density before a change in the morning from ACE instrumentation to DSCOVR. Interplanetary Magnetic Field, Bt, remained at Moderate levels, peaking at 13nT at 27/0010 UTC. The north-south component was largely variable with a minimum of -10nT at 27/0854 UTC and a peak of +10nT at 27/1532 UTC. Phi angle was positive (away from the Sun) throughout. Geomagnetic activity was Unsettled to Active (Kp 3-4) with a G2/Kp6 Moderate geomagnetic storm between 27/0900-1200 UTC.

Energetic Particles / Solar Radiation: High energy proton flux (greater than 10MeV) at GOES18 was slightly above background, but below the the S1/Minor Radiation and declining. The high energy electron flux was a normal background to moderate levels, with a peak flux of 189 pfu at 27/1925 UTC. The 24-hour fluence was below the Active threshold (1e8 integrated pfu), recording 2.63e6 integrated pfu at 28/0000UTC.

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Four-Day Space Weather Forecast Summary

Solar Activity: Low to Moderate activity is forecast with isolated M-class flares likely at first, reducing to a chance of isolated M-class flares from day 3 (2nd Mar).

Solar Wind / Geomagnetic Activity: Glancing CME influences still can't be completely ruled out today (28 Feb) from the filament eruptions 26/0600UTC and 26/1445 UTC. Wind speeds are likely to remain elevated or strong until day 4 (3rd Mar) then likely decreasing to Slightly Elevated levels. Unsettled to Active (Kp 3-4) geomagnetic activity is expected until day 4 (3rd Mar) with perhaps isolated G1-G2/Minor to Moderate geomagnetic storms (Kp 5-6), most likely today (28 Feb). Through Day 4 (3rd March) geomagnetic activity is expected to decline to predominantly Quiet to Unsettled (Kp 2-3) levels.

Energetic Particles / Solar Radiation: High energy proton flux is currently below the S1 Minor Storm level, and is expected to continue declining to reach background levels, with only a slight chance of further enhancements. High energy electron flux is expected to be at background. The associated 24 hour fluence is expected to remain below the Active (1e8 integrated pfu) threshold.

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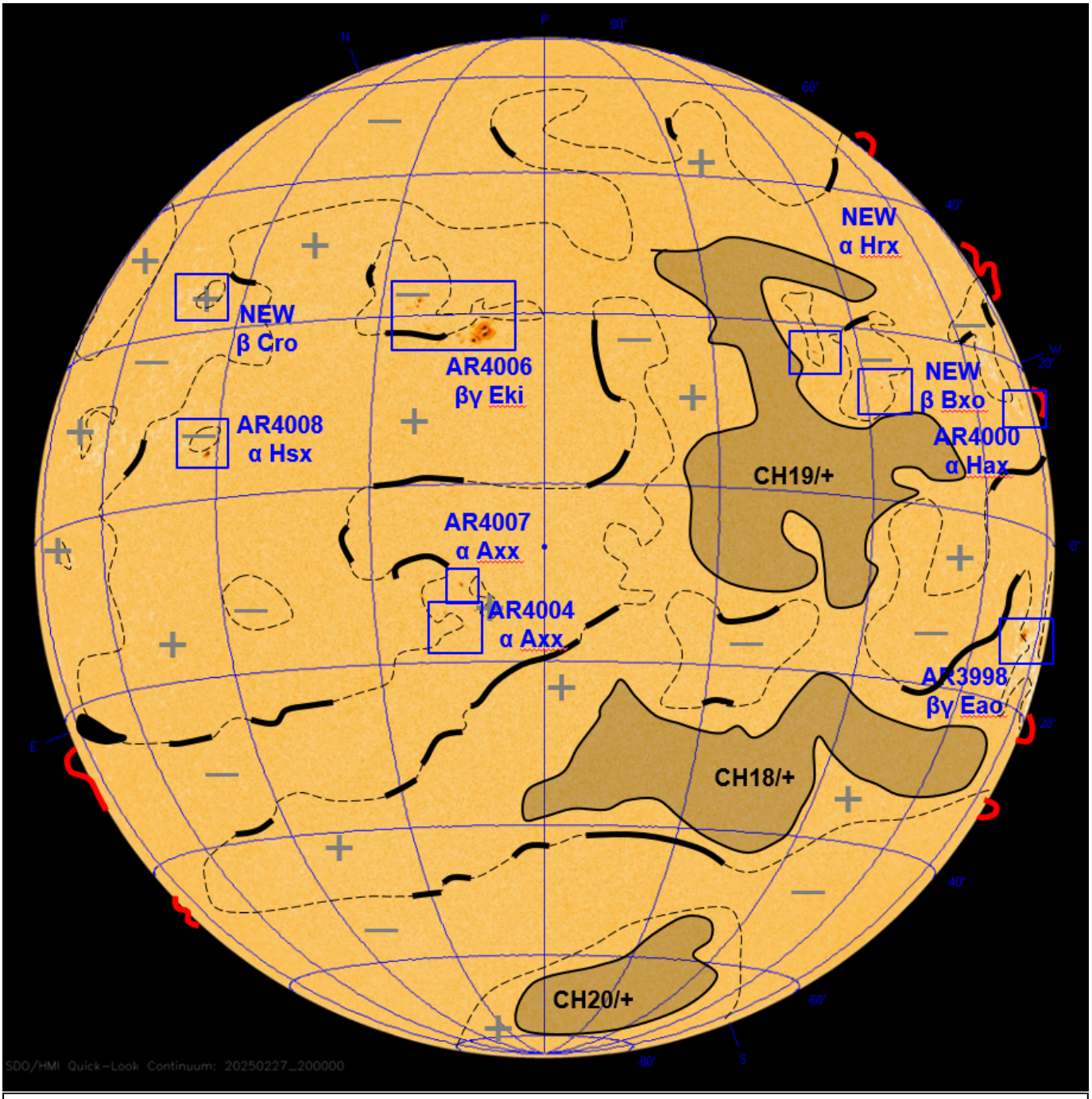
Figure 1: Synoptic map valid 27/2000 UTC



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms

Several filament eruptions occurred on 24th Feb, and although none are expected to be Earth directed weak glancing blows from one or more of the associated CME's can't be ruled out for today, as indicated by a few of the members of MOSWOC Enlil ensemble. The most likely CME arrival, but still with low confidence, could occur late today. More recently a filament eruption in the north around 27/0500UTC appears to have been reabsorbed. A filament eruption which occurred around 27/1730 UTC near the NE limb generated a CME, which is yet to be fully analysed but is not expected to be Earth directed.

Solar winds at Earth are currently Elevated, due to a connection with CH19/+. On the previous rotation of this (persistent) coronal hole feature the solar winds reached Strong levels, and this is likely to occur at times through days 1, 2 and 3 (28th Feb to 2nd Mar). MOSWOC Enlil is therefore accepted. During day 4 (3rd Mar) the solar wind is likely to decline to slightly elevated levels.

Unsettled to Active (Kp 3-4) geomagnetic activity is expected until day 4 (3rd Mar) with perhaps isolated G1-G2/Minor to Moderate geomagnetic storms (Kp 5-6), most likely today (28 Feb). Through Day 4 (3rd March) geomagnetic activity is expected to decline to predominantly Quiet to Unsettled (Kp 2-3) levels.

Geomagnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	Yes	60	40	20	10
Strong	G3	No	5	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Date/time 21.5R⊙ (UTC)	Halo: Full or Partial	Source	Source Location	Estimated Speed (km/s)	Estimated Arrival Time (UTC)	Comments
26/1847	Partial	Filament	SW	945	28/2100 +/-12 hrs	Low confidence. Glancing blow but not expected.

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Figure 2: Latest MOSWOC Enlil.

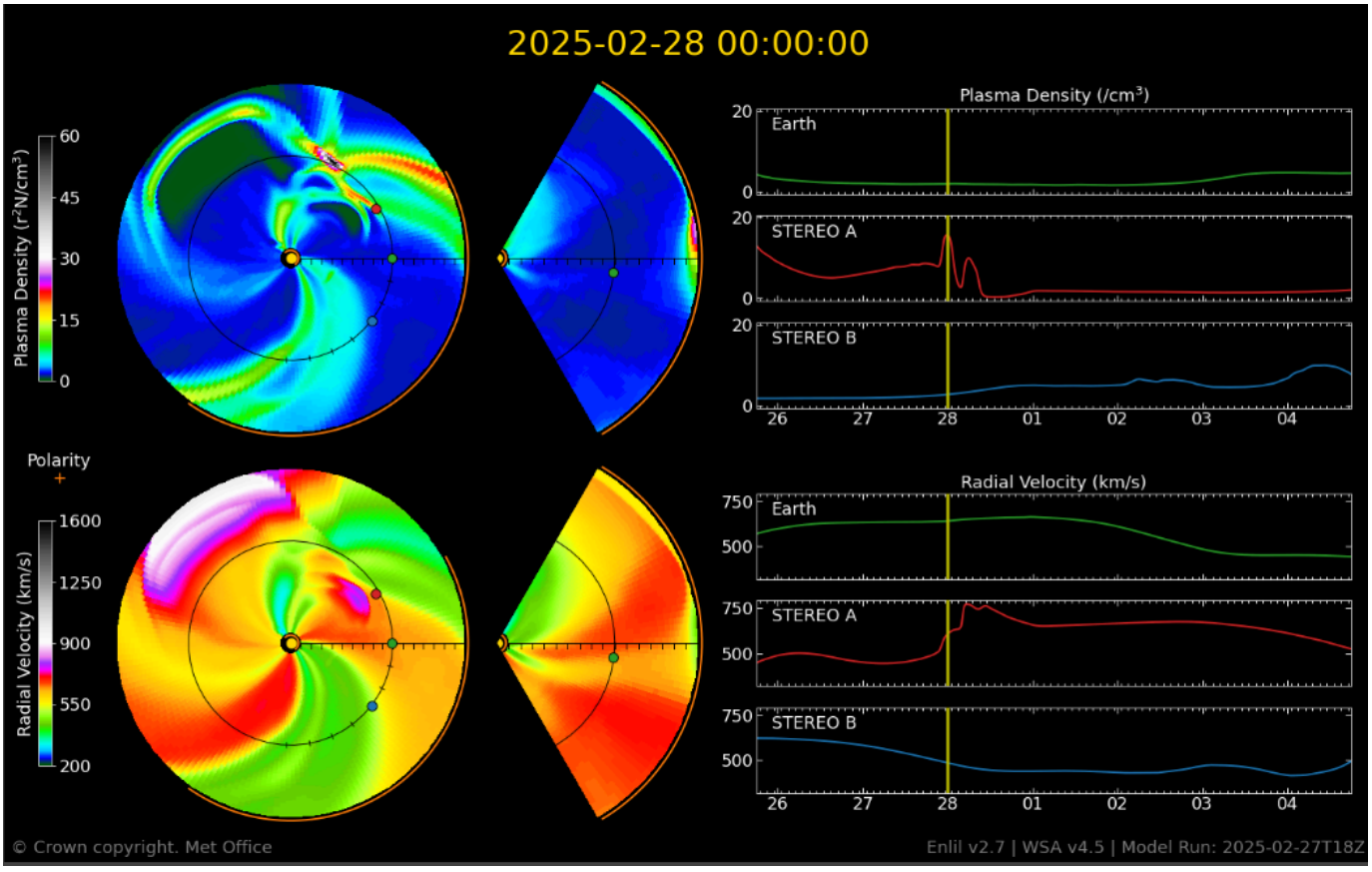
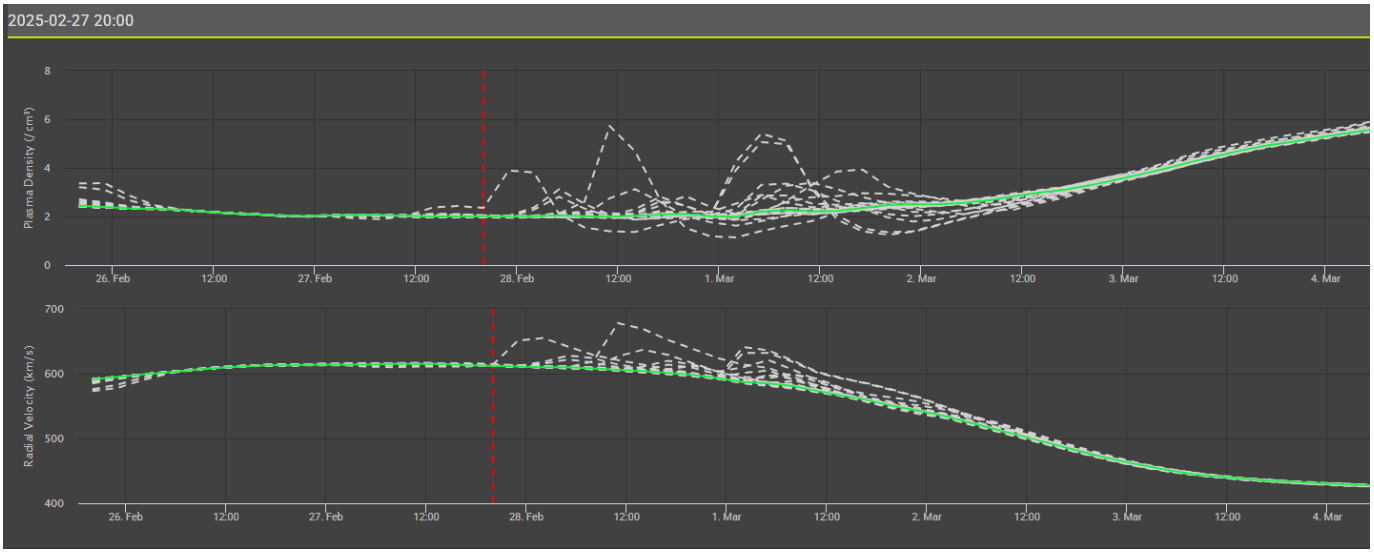


Figure 3: Latest MOSWOC Enlil ensemble.


2025-02-27 20:00
Plasma Density (/cm³)
Radial Velocity (km/s)
26. Feb 12:00 27. Feb 12:00 28. Feb 12:00 1. Mar 12:00 2. Mar 12:00 3. Mar 12:00 4. Mar

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Radio Blackouts - X-Ray Flares

There are nine sunspot regions on the Earth-facing disc, with AR3996 recently rotating onto the west limb. AR3998 in the southwest and AR4006 in the northeast are the most complex sunspot regions on the disc at present. AR3998 appears to have recently slightly decreased in area, although this may be due to the region's viewing angle as it approaches the west limb. Because of the difficulty with the viewing angle the previous classification has been retained. AR4006 has the potential to develop a weak delta spot if penumbra increases around some small intermediate spots, but currently a classification of Eki/beta-gamma persists. There are currently three unnumbered regions in the northern hemisphere, these are small simple regions at the moment. The remaining spots are all magnetically simple and either stable or showing slight decay.

Low to Moderate solar activity is forecast with isolated M-class flares likely today, decreasing to a chance of isolated M-class flares from day 2 (1st March) as AR3998 rotates further behind the southwest limb.

X-Ray Flares Probability	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**R1-R2 (M Class)**	No	50	50	45	45
Very Active	**R3-R5 (X Class)**	No	5	5	1	1

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Solar Radiation Storms (High Energy Protons)

GOES-18 high energy (>10MeV) proton flux remains slightly above background after the S1 Minor Radiation Storm that occurred on 25 Feb. The most likely source of any further enhancement would be from AR3998 in the southwest. However, despite several C-class flares from AR3998, including the C9.3 at 27/2324, none of the flares have influenced the continued declining trend of the high energy protons. In addition AR3998 will rotate behind the southwest limb early in the forecast period. Therefore only a slight, and decreasing, chance of S1 Minor radiation Storms is forecast.

Radiation Storms Probability (Exceedance)	Level ($cm^{-2}sr^{-1}s^{-1}$)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	10	10	5	5
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and/or 50 MeV ≥ 10pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

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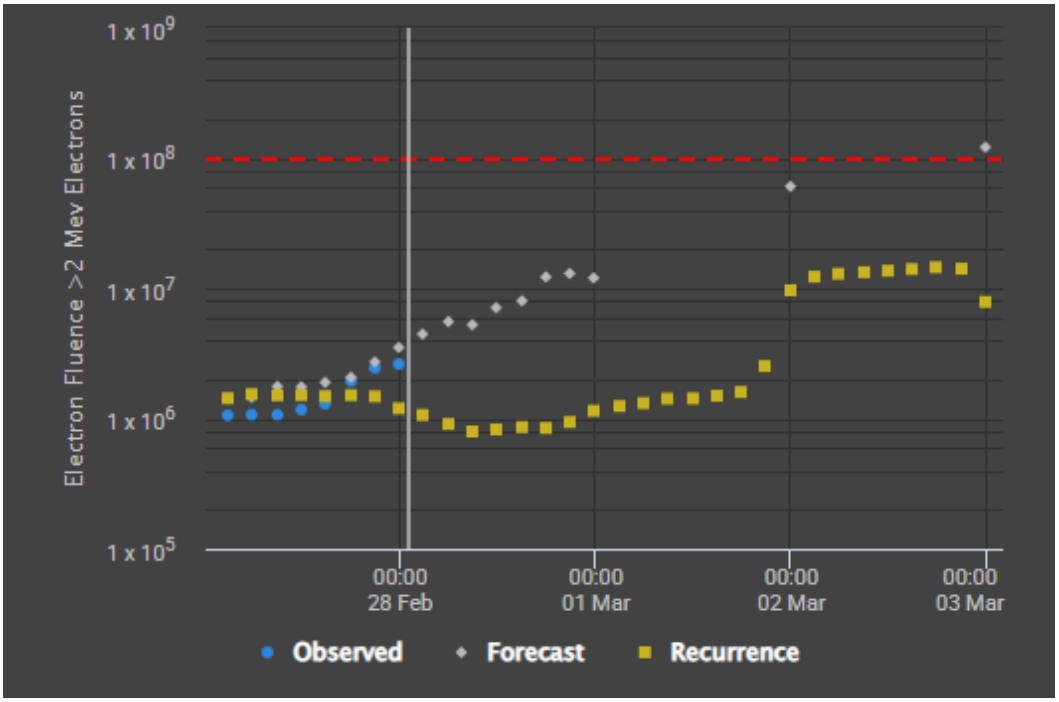
High Energy Electrons (≥ 2MeV)

The high energy electron flux (>2MeV), as observed at GOES-16 is at background to moderate levels. A general increasing trend is expected, especially late in the period when the HSS starts to decline, with the flux possibly reaching High levels at the peaks of the diurnal cycle during days 3 and 4 (2nd and 3rd Mar).

The associated 24 hour fluence is currently below Active and is expected to remain below Active. MOSWOC REFM is currently indicating that the fluence will breach the Active level on day 3 (2nd Mar), which is considered unlikely, although the overall increasing trend is accepted.

GEO Electron Environment	Level ($cm^{-2}sr^{-1}$ day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ 2 MeV ≥ 1×10^8	No	1	1	20	30
Very Active	≥ 2 MeV ≥ 1×10^9	No	1	1	1	1

Figure 4: Latest MOSWOC REFM model.



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